



LONDON- WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 5 | Technical Appendices

CFA21 | Drayton Bassett, Hints and Weeford

Water resources assessment (WR-002-021)

Water resources

November 2013

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Department for Transport

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Appendix WR-002-021

Environmental topic:	Water resources and flood risk assessment	WR
Appendix name:	Water resources assessment	002
Community forum area:	Drayton Bassett, Hints and Weeford	021

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1 Introduction

1.1 Structure of the water resources and flood risk assessment appendices

- 1.1.1 The water resources and flood risk assessment appendices comprise four parts. The first of these is a route-wide appendix (Appendix WR-001-000).
- 1.1.2 Three specific appendices for each community forum area (CFA) are also provided. For the Drayton Bassett, Hints and Weeford area (CFA21), these are:
 - a water resources assessment (i.e. this appendix);
 - a flood risk assessment (Appendix WR-003-021); and
 - a river modelling report (Appendix WR-004-014).
- 1.1.3 Maps referred to throughout the water resources and flood risk assessment appendices are contained in the Volume 5: Map Book – Water resources, Maps WR-01 to WR-06 and the Volume 5: Map Book – Ecology, Maps EC-01 to EC-04.

1.2 Study area

- 1.2.1 The study area for Drayton Bassett, Hints and Weeford is located between Drayton Bassett and Whittington and within the county of Staffordshire. The study area is predominantly rural and overlies several superficial and bedrock aquifers. Topography varies between 80 and 105m above ordnance datum (AOD).
- 1.2.2 The spatial scope of the surface water assessment was based upon the identification of surface water and groundwater features within 1km of the centreline of the Proposed Scheme, except where there is clearly no hydraulic connectivity. For surface water features in urban areas, the extent was reduced to 500m. Outside of these distances it is unlikely that direct impacts upon the water environment will be attributable to the Proposed Scheme. Where works extend more than 200m from the centreline, for example at stations and depots, professional judgement was made in selecting the appropriate limit to the extension in spatial scope required. For the purposes of this assessment this is defined as the study area.
- 1.2.3 Due to the number of ponds and other water features present within the study area, only those either within the land required for the construction or operation of the scheme, or within the calculated zone of influence (i.e. those potentially affected by the Proposed Scheme) have been detailed in the baseline.

2 Stakeholder engagement

2.1.1 Discussions with the following stakeholders has been undertaken to inform the water resources assessment.

- the Environment Agency on 31 September 2012 to discuss multiple aspects of the Proposed Scheme;
- the Environment Agency and Staffordshire Lead Local Flood Authority (LLFA) on 21 December 2012; and
- the Environment Agency on 4 June 2013.

3 Baseline data

3.1 General

3.1.1 The following section provides a current description of water resources including surface water and groundwater.

3.2 Surface water features

3.2.1 All surface water features within 1km of the route are presented in Table 1.

3.2.2 The current surface water baseline is shown in the Volume 5: Maps WR-01-035 and WR-01-036. Where a water feature in Table 1 has been given a map reference it appears on one of these maps.

Appendix WR-002-021 | Baseline data

Table 1: Surface water features within 1km of the route in CFA21

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated)	Receptor Value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary of Gallows Brook	North of Church Lane, 220m east of the route Map WR-01-035 (H5)	Ordinary watercourse	Langley Brook from Middleton Hall Catchment to River Tame (GB104028046900) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Gallows Brook	East of Upper House Farm. Will be crossed by the route Map WR-01-035 (H5) (SWC-CFA21-001)	Ordinary watercourse	Langley Brook from Middleton Hall Catchment to River Tame (GB104028046900) Poor Status	Good Status	Moderate	0m³/s	River Tame	0.570km²	
Tributary of River Tame	Source to Trickley Coppice. Will be crossed by the route Map WR-01-035 (G5) (SWC-CFA21-002)	Ordinary watercourse	Langley Brook from Middleton Hall Catchment to River Tame (GB104028046900) Poor Status	Good Status	Moderate	0.002m³/s	River Tame	2.055km²	

¹ Only ponds under the land take for the proposed scheme are listed in this table.

² Map references taken from Volume 5: Map Book – water resources, Maps WR-01-035 and WR-01-036.

³ Environment Agency water-feature classification: The Land Drainage Act 1991 defines an Ordinary watercourse as 'A watercourse that is not part of a main river, all rivers and streams, ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers) and passages through which water flows'. 'Main Rivers' are larger rivers and streams designated by DEFRA, main rivers are regulated by the Environment Agency.

⁴ Year may vary in different RBMPs.

⁵ Environment Agency (2009), *River Basin Management Plan: Humber River Basin District*.

⁶ For examples of receptor value see Table 43 in the SMR addendum Volume 5 Appendix CT-001-000/2.

⁷ Q95 flow values only provided for water features that will be crossed by the route.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated)	Receptor Value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary of River Tame	Crossing south of Shirral Drive. Will be crossed by the route Map WR-01-035 (G5) (SWC-CFA21-003)	Ordinary watercourse	Langley Brook from Middleton Hall Catchment to River Tame (GB104028046900) Poor Status	Good Status	Moderate	0.002m3/s	River Tame	2.055km2	
Drain	At Trickley Coppice. 995m south-west of the route Map WR-01-035 (G7)	Ordinary watercourse	Langley Brook from Middleton Hall Catchment to River Tame (GB104028046900) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Tributary of Langley Brook	North of Oak Farm located 600m north-east of the route Map WR-01-035 (G4)	Ordinary watercourse	Langley Brook from Middleton Hall Catchment to River Tame (GB104028046900) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Pond	South of Shirral Drive. Will be crossed by the route Map WR-01-035 (G5) (SWC-CFA21-004)	Refer to Ecology Volume 2, CFA Report 21, Section 7.	Not applicable	Not applicable	Refer to ecology (Volume 2, CFA Report 21, Section 7) for receptor value for ponds.	-	River Tame		
Pond	At Barn Cottage. Will be crossed by the route Map WR-01-035 (F5) (SWC-CFA21-005)	Refer to Ecology Volume 2, CFA Report 21, Section 7.	Not applicable	Not applicable	Refer to ecology (Volume 2, CFA Report 21, Section 7) for receptor value for ponds.	-	River Tame		

Appendix WR-002-021 | Baseline data

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated)	Receptor Value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary of Bourne Brook	At Bourne Brook Farm. Extended culvert – 830m north-east of the route Map WR-01-035 (E4)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Tributary of Bourne Brook	At Lower Bangley Farmhouse located 465m north-east of the route Map WR-01-035 (E5)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Tributary of Bourne Brook	At Bangley Lane (known locally as Waggoner's Lane). Located 60m north-east of the route Map WR-01-035 (E5)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Lake	At Lower Bangley Farmhouse 640m north-east of the route Map WR-01-035 (E5)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Drain	At Lower Bangley Farmhouse located 630m north-east of the route Map WR-01-035 (E5)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated)	Receptor Value ⁶	Q95 ⁷	Catchment	Size	Notes
Drain	At Lower Bangley Farmhouse located 650m north-east of the route Map WR-01-035 (E5)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Drain	At Mill House located 305m south-west of the route Map WR-01-035 (E6)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Tributary of Bourne Brook	At Fordway Farm located 600m north-east of the route Map WR-01-035 (D5)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Tributary of Bourne Brook	At White House Farm. Will be crossed by the route Map WR-01-035 (D6) (SWC-CFA21-006)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	0.001m³/s	River Tame	0.537km²	

Appendix WR-002-021 | Baseline data

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated)	Receptor Value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary of Bourne Brook	At Roundhill Wood. Will be crossed by the route – extended culvert Map WR-01-035 (D6) (SWC-CFA21-007)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	0.002m3/s	River Tame	1.101km2	
Tributary of Bourne Brook	Second crossing At Roundhill Wood. Will be crossed by the route Map WR-01-035 (D6) (SWC-CFA21-008)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	0.002m3/s	River Tame	1.101km2	
Drain	Downstream of Holt Farm – Feeder drain to Black Brook located 680m east of the route Map WR-01-035 (D4)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Tributary of Bourne Brook	At Botley House located 420m north-east of the route Map WR-01-035 (D5)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated)	Receptor Value ⁶	Q95 ⁷	Catchment	Size	Notes
Black Brook	At Bourne House. Will be crossed by the route Map WR-01-035 (B5) (SWC-CFA21-009)	Main river	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	High	0.241m ³ /s	River Tame	85.9km ²	
Tributary of Black Brook	At Bourne House located 230m west of the route Map WR-01-035 (B5)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Lake / Reservoir	At Bourne Cottage with throughflow to Black Brook located 180m south-west of the route Map WR-01-035 (B5)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Watercourse	At Bourne Cottage located 180m west of the route Map WR-01-035 (B5)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Drain	Black-Brook at Weeford Square located 950m south-west of the route Map WR-01-035 (B5)	Ordinary watercourse	Black-Bourne Brook from source (confluence) to River Tame (GB104028047000) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.

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Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated)	Receptor Value ⁶	Q95 ⁷	Catchment	Size	Notes
Lake / Reservoir	Lake / Reservoir on Moor Covert with through flow to Fisherwick Brook. Located 340m west of the route Map WR-01-036 (E6)	Ordinary watercourse	East Litchfield catchment (tributary of Tame) (GB104028047020) Moderate Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Tributary to Swinfen Lake	At Moor Covert located 620m west of the route Map WR-01-036 (D7)	Ordinary watercourse	East Litchfield catchment (tributary of Tame) (GB104028047020) Moderate Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Tributary to Swinfen Lake	At The Belt located 755m west of the route Map WR-01-036 (D7)	Ordinary watercourse	East Litchfield catchment (tributary of Tame) (GB104028047020) Moderate Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Drain	In a woodland area south-east of Swinfen Lake located 750m west of the route Map WR-01-036 (D7)	Ordinary watercourse	East Litchfield catchment (tributary of Tame) (GB104028047020) Moderate Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.
Tributary of Brook Leasow	At Paddington Hall Farm located 690m east of the route Map WR-01-036 (D4)	Ordinary watercourse	River Tame from River Anker to River Trent (GB104028047050) Poor Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.

Water feature ¹	Location description (map reference) ²	Watercourse classification ³	Water Framework Directive (WFD) water body name and identifier and overall status	WFD status objective (by 2027 ⁴ as per River Basin Management Plan (RBMP) ⁵ unless stated)	Receptor Value ⁶	Q95 ⁷	Catchment	Size	Notes
Tributary to Swinfen Lake	At Bog Wood located 600m west of the route Map WR-01-036 (C7)	Ordinary watercourse	East Litchfield catchment (tributary of Tame) (GB104028047020) Moderate Status	Good Status	Moderate	-	River Tame		Will not be crossed by the route.

3.2.3 Table 2 summarises licensed surface water abstractions within 1km of the route⁸. Information from Lichfield District Council indicates that there are no unlicensed abstractions from surface water used for potable supply in their records.

Table 2: Licensed surface water abstractions

Licence identifier (map reference number ⁹ and Environment Agency reference)	Distance from route	Abstraction source	Maximum annual abstraction quantity	Maximum daily abstraction quantity	Purpose
03/28/16/0081 Map WR-01-035 (G5)	175m north-east of the route	Brook Farm, Drayton Bassett – Tributary River Tame	38,250m ³	600m ³	Spray irrigation – storage
03/28/17/0023 Map WR-01-035 (D4)	705m north-east of the route	Hints, Tamworth – Bourne Brook (1)	2,728m ³	227m ³	Spray irrigation – direct
03/28/17/0045 Map WR-01-035 (C5)	200m north-east of the route	Home Farm, Hints – Spring – Fed Pool	9,245m ³	510m ³	Spray irrigation – direct
03/28/17/0044 Map WR-01-035 (C5)	155m north-east of the route	Home Farm, Hints – Bourne Brook	2,500m ³	510m ³	Spray irrigation – direct
03/28/17/0059 Map WR-01-035 (B5)	170m south-west of the route	Buck's Head Farm, Weeford – Black Brook	104,600m ³	2,530m ³	Spray irrigation – direct
03/28/17/0060 Map WR-01-035 (B5)	170m south-west of the route	Buck's Head Farm, Weeford – Black Brook	10,000m ³	500m ³	Spray irrigation – storage
03/28/22/0019 Map WR-01-036 (D6)	385m west of the route	Packington Moor Farm – Reservoir	33,260m ³	1,269m ³	Spray irrigation – direct
03/28/22/0089 Map WR-01-036 (D6)	385m west of the route	Online Reservoir on Packington Brook	46,900m ³	1,381m ³	Spray irrigation – direct

3.2.4 Table 3 summarises surface water discharge consents within 1km of the route.

Table 3: Permitted discharges to surface water

Reference number and map reference ¹⁰	Permit identifier	Distance from route	Discharge type	Receiving water body
26342613 Map WR-01-035 (H4)	T/16/36006/S	905m north-east of the route	Sewage discharge	Tributary of Langley Brook
1465324 Map WR-01-035 (G5)	T/16/22546/S	160m north-east of the route	Sewage discharge	Shirrall Brook

⁸ Surface water abstractions for public supply are not included.⁹ Map references taken from Volume 5: Map Book – Water resources, Maps WR-01-035 and WR-01-036.¹⁰ Map references taken from Volume 5: Map Book – Water resources, Maps WR-01-035 and WR-01-036.

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Reference number and map reference ¹⁰	Permit identifier	Distance from route	Discharge type	Receiving water body
1244493 Map WR-01-035 (G5)	CT/18/35049/S/1	545m north-east of the route	Sewage discharge	Drayton Bassett Brook
1244375 Map WR-01-035 (G5)	T/18/35049/S	545m north-east of the route	Sewage discharge	Tributary of River Tame
19334414 Map WR-01-035 (G5)	T/17/35608/S	460m north-east of the route	Sewage discharge	Tributary of Canwell Brook
1244281 Map WR-01-035 (F7)	T/16/01779/S	960m south-west of the route	Sewage discharge	Tributary of River Tame
21510527 Map WR-01-035 (F4)	T/22/35847/S	810m north-east of the route	Sewage discharge	Ditch/Tributary of Bourne/Black Brook
1244235 Map WR-01-035 (E5)	T/16/03464/S/1	785m north-east of the route	Sewage discharge	Langley Brook
1244233 Map WR-01-035 (E6)	T/22/22765/S	420m south-west of the route	Sewage discharge	Bangley Drain
1244265 Map WR-01-035 (E6)	T/17/01684/S	310m south-west of the route	Sewage discharge	Tributary of Bourne/Black/Crane Brook
1244269 Map WR-01-035 (E5)	T/17/01687/S	360m north-east of the route	Sewage discharge	Tributary of Bourne/Black/Crane Brook
1244267 Map WR-01-035 (E6)	T/17/01685/S	160m south-west of the route	Sewage discharge	Tributary of Bourne/Black/Crane Brook
1244271 Map WR-01-035 (D5)	T/17/01686/S	465m north-east of the route	Sewage discharge	Tributary of Bourne/Black/Crane Brook
20999460 Map WR-01-035 (D5)	T/17/35806/R	655m north-east of the route	Sewage discharge	Bourne Brook
20999461 Map WR-01-035 (D5)	T/17/35806/R	655m north-east of the route	Sewage discharge	Bourne Brook
80511404 Map WR-01-035 (D5)	T/17/35806/R	655m north-east of the route	Sewage discharge	Bourne Brook
1244275 Map WR-01-035 (D5)	T/17/12055/R	655m north-east of the route	Sewage discharge	Bourne Brook
20999462 Map WR-01-035 (D5)	T/17/35806/R	655m north-east of the route	Trade discharge	Bourne Brook
22690403 Map WR-01-035 (B5)	T/17/35914/S	195m west of the route	Sewage discharge	Tributary of Bourne/Black Brook
1244589 Map WR-01-035 (B6)	T/17/01877/S/1	675m west of the route	Sewage discharge	Receiving water body not defined in Envirocheck data.
1244570 Map WR-01-035 (B6)	T/17/01167/S/1	940m west of the route	Sewage discharge	Bourne/Black/Crane Brook
1244690 Map WR-01-035 (B6)	T/17/30192/S	785m west of the route	Sewage discharge	Black Brook
1243696 Map WR-01-036 (D5)	T/22/30087/O	900m east of the route	Sewage discharge	Tributary of River Tame

Reference number and map reference ¹⁰	Permit identifier	Distance from route	Discharge type	Receiving water body
96122652 Map WR-01-036 (D5)	Tsc3132	900m east of the route	Sewage discharge	Tributary of River Tame
1243914 Map WR-01-036 (C6)	T/22/07310/T/1	45m east of the route	Surface water discharge	Darnford Brook (Tame)

3.3 Groundwater

- 3.3.1 The study area crosses two groundwater bodies; Tame Anker Mease – Secondary Combined (GB40402G990800) and Tame Anker Mease PT (Permo-Triassic) Sandstone Birmingham Lichfield (GB40401G301000) (see Volume 5: Maps WR-03-035 and WR-03-036).
- 3.3.2 The Tame Anker Mease – Secondary Combined groundwater body is composed of Mercia Mudstone Group. The groundwater within the geological formations is currently of good current quantitative quality and poor chemical quality status.
- 3.3.3 Tame Anker Mease – PT Sandstone Birmingham Lichfield is composed of Bromsgrove Sandstone Formation, Kidderminster Formation and Salop Formation (Envile Member). The groundwater within the water body is currently of poor current quantitative quality and poor chemical quality status.
- 3.3.4 The Bromsgrove Sandstone Formation and Kidderminster Formation within the study area within a groundwater Source Protection Zone 3 (SPZ3).
- 3.3.5 Table 4 summarises licensed groundwater abstractions within the study area, there are no boreholes used for public water supply within this study area (see Volume 5: Map WR-02-021).

Table 4: Licensed groundwater abstractions

Licence identifier (map reference number ¹¹ and Environment Agency reference)	Distance from route	Abstraction horizon	Maximum annual abstraction quantity	Maximum daily abstraction quantity	Number of boreholes covered by licence	Purpose
03/28/17/0076/1 Map WR-02-021 (F7), 4.9km south-west of Black Brook viaduct	1,420m south-west of the route	Envile Member	40,000m ³	1,584m ³	1	Agriculture
03/28/17/0043 Map WR-02-021 (F6), 1.6km south-east of Black Brook viaduct	750m north-east of the route	Either Alluvium or Mercia Mudstone Group	4,546m ³	455m ³	1	Agriculture

¹¹ Map references taken from Volume 5: Map Book – Water resources, Map WR-02-021.

Licence identifier (map reference number ¹¹ and Environment Agency reference)	Distance from route	Abstraction horizon	Maximum annual abstraction quantity	Maximum daily abstraction quantity	Number of boreholes covered by licence	Purpose
03/28/17/0048 Map WR-02-021 (E6), 1km east of Black Brook viaduct	1,000m east of the route	Not Known	90,000m ³	300m ³	1	Industrial Commercial and public services.
03/28/17/0041 Map WR-02-021 (E6), 1km north-east of Black Brook viaduct	830m east of the route	Likely to be Bromsgrove Sandstone Formation	181,818m ³	985m ³	1	Industrial Commercial and public services.
03/28/22/0036 Map WR-02-021 (E5), 1.8km north-east of Black Brook viaduct	1,520m east of the route	Likely to be Bromsgrove Sandstone Formation	140,000m ³	430m ³	1	Industrial, commercial and public services
03/28/22/0062 Map WR-02-021 (E7), 900m north-west of Black Brook viaduct	300m west of the route	Likely to be Bromsgrove Sandstone Formation	27,500m ³	900m ³	1	Agricultural
03/28/22/0038 Map WR-02-021 (D7), 2km north-west of Black Brook viaduct	340m west of the route	Likely to be Bromsgrove Sandstone Formation	52,891m ³	1,968m ³	1	Agricultural

3.3.6 Table 5 summarises permitted discharges to groundwater within the study area.

Table 5: Groundwater discharge environmental permits

Reference number and map reference ¹²	Permit identifier	Distance from route	Discharge type	Receiving water body
3/28/16/0619/1 Map WR-02-021 (G6), 700m south-west of Drayton Bassett viaduct	465220	500m south-west of the route	Sewage effluent	Groundwater
3/28/16/0618/1 Map WR-02-021 (E7), 800m south-west of Drayton Bassett viaduct	1465219	1200m south-west of the route	Sewage effluent	Groundwater
3/28/17/1870 Map WR-02-021 (E7), 500m north-west of Black Brook viaduct	1244594	300m east of the route	Sewage effluent	Land and soakaway
3/28/17/0922/1 Map WR-02-021 (E7), 550m north-west of Black Brook viaduct	1244659	450m east of the route	Sewage effluent	Groundwater
3/28/17/1868 Map WR-02-021 (E7), 800m north-west of Black Brook viaduct	1244619	420m west of the route	Sewage effluent	Land and soakaway

¹² Map references taken from Volume 5: Map Book – Water resources, Map WR-02-021.

Reference number and map reference ¹²	Permit identifier	Distance from route	Discharge type	Receiving water body
3/28/17/1871 Map WR-02-021 (E7), 1.1km north-west of Black Brook viaduct	1244623	370m west of the route	Sewage effluent	Land and soakaway
Wq/72/1516 Map WR-02-021 (G5), 1.5km north-east of Drayton Bassett viaduct	1244334	650m north-east of the route	Sewage effluent	Land and soakaway
3/28/17/1650/1 Map WR-02-021 (E7), 1.1km north-west of Black Brook viaduct	1244665	280m west of the route	Sewage effluent	Groundwater
3/28/17/1869 Map WR-02-021 (E7), 1.2km north-west of Black Brook viaduct	1244598	850m west of the route	Sewage effluent	Land and soakaway
Eprnp3521gn Map WR-02-021 (D6), 2km north of Black Brook viaduct	103518686	50m west of the route	Sewage effluent	Land and soakaway
Wq/72/189 Map WR-02-021 (C6), 2.8km north-east of Black Brook viaduct	1243793	600m east of the route	Sewage effluent	Land and soakaway
T/22/22423/Sg Map Farm WR-02-021 (D6), 3.9km north of Black Brook viaduct	1243953	250m west of the route	Sewage effluent	Land and soakaway
3/28/17/0923/1 Map WR-02-021 (E7), 500m north-west of Black Brook viaduct	1244662	900m south-west of the route	Sewage effluent	Groundwater
WQ/72/1567/1 Map WR-02-021 (D6), 4km north-west of Black Brook viaduct	1243996	830m west of the route	Sewage effluent	Groundwater
3/28/17/2474/1 Map WR-02-021 (E7), 350m north-west of Black Brook viaduct	1244725	275m south-west of the route	Sewage effluent	Groundwater
T/17/14362/Sg Map WR-02-021 (E7), 500m north-west of Black Brook viaduct	1457987	300m west of the route	Sewage effluent	Land and soakaway
WQ/72/294/1 Map WR-02-021 (E7), 1.3km north-west of Black Brook viaduct	1244574	1,000m west of the route	Sewage effluent	Groundwater
T/17/35976/S Map WR-02-021 (E7), 1.3km north-west of Black Brook viaduct	22967721	1,100m west of the route	Sewage effluent	Land soakaway
3/28/22/1997/1 Map WR-02-021 (D5), 3.3km north-east of Black Brook viaduct	1243703	1,350m east of the route	Sewage effluent	Groundwater

3.4 Groundwater/surface water interaction

- 3.4.1 Table 6 summarises springs, issues (locations where groundwater rises to the surface in a more diffuse way than at a spring), and sinks the study area. Due to the number of ponds and other water features present within the study area, only those either within the land required for the construction or operation of the Proposed Scheme, or within the calculated zone of influence are included in Table 6.

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Table 6: Groundwater/surface water interaction

Location description and map reference¹³	Distance from route	Formation	Elevation	Comments
Pond 670m east of Upper House Farm Map EC-04-059 (J6), 380m south of Drayton Bassett viaduct	60m west of the route	Mercia Mudstone Group	86mAOD	May receive groundwater from Mercia Mudstone Group, issues located nearby suggesting that there could be high groundwater levels.
Pond 670m east of Upper House Farm Map EC-04-059 (J6), 380m south of Drayton Bassett viaduct	50m west of the route	Mercia Mudstone Group	86mAOD	May receive groundwater from Mercia Mudstone Group issues located nearby suggesting that there could be high groundwater levels.
Pond 670m east of Upper House Farm Map EC-04-059 (I6), 380m south of Drayton Bassett viaduct	30m west of the route	Mercia Mudstone Group	86mAOD	May receive groundwater from Mercia Mudstone Group issues located nearby suggesting that there could be high groundwater levels.
Pond 670m east of Upper House Farm Map EC-04-059 (I6), 380m south of Drayton Bassett viaduct	55m west of the route	Mercia Mudstone Group	86mAOD	May receive groundwater from Mercia Mudstone Group issues located nearby suggesting that there could be high groundwater levels.
Pond 744m east of Upper House Farm Map EC-04-059 (I6), 360m south of Drayton Bassett viaduct	25m east of the route	Mercia Mudstone Group	86mAOD	Pond located in a disused marl pit therefore unlikely to be groundwater dependent.
Issues 570m east of Upper House Farm Map WR-02-021 (H5), 650m east of Drayton Bassett viaduct	200m south-west of the route	Alluvium underlain by Mercia Mudstone Group	83mAOD	May receive groundwater from Alluvium.
Issues at Trickley Coppice Map WR-02-021 (G6), 1.2km south of Drayton Bassett viaduct	1,300m south-west of the route	Mid Pleistocene Till Superficial deposits underlain by Mercia Mudstone Group	115mAOD	May receive groundwater from Mercia Mudstone Group.
Issues at 150m north-west of Trickley coppice Map WR-02-021 (G6), 1.2km south of Drayton Bassett viaduct	1,300m south-west of the route	Mid Pleistocene Till Superficial deposits underlain by Mercia Mudstone Group	120mAOD	May receive groundwater from Mercia Mudstone Group.
Pond at Barn Cottage Map EC-04-059 (G6), 300m west of Drayton Bassett viaduct	Pond will be crossed by the route	Mercia Mudstone Group	103mAOD	May receive groundwater from Mercia Mudstone Group.
Unnamed watercourse Map WR-02-021 (I5), 512m south-west of Drayton Bassett viaduct	Will be crossed by the route	Mercia Mudstone Group, Till Mid Pleistocene	Not applicable	Potentially surface water dependent and it is located on Unproductive strata.

¹³ Map references taken from Volume 5: Map Book – Water resources, Map WR-02-021 and Volume 5: Map Book – Ecology, Maps EC-04-061.

Location description and map reference¹³	Distance from route	Formation	Elevation	Comments
Issues 220m north of Oak Farm Map WR-02-021 (F5), 2km north-east of Black Brook viaduct	580m north-east of the route	Mid Pleistocene Till Superficial deposits underlain by Mercia Mudstone Group	92mAOD	May receive groundwater from Mercia Mudstone Group.
Pond 150m west of Stone House Map EC-04-059 (F6), 300m west of Drayton Bassett viaduct	Pond will be crossed by the route	Mercia Mudstone Group	103mAOD	May receive groundwater from Mercia Mudstone Group.
Pond 120m east of Cranebrook Map EC-04-059 (E6), 1.6km north-west of Drayton Bassett viaduct	80m east of the route	Mercia Mudstone Group	107mAOD	Located on elevated topography therefore may be surface water dependent.
Issues at Woodside Farm Map WR-02-021 (F5), 2.0km west of Drayton Bassett viaduct	50m north-east of the route	Mid Pleistocene Till superficial deposits underlain by Mercia Mudstone Group	95mAOD	May receive groundwater from Mercia Mudstone Group.
Sinks 215m south-east of White House Farm Map WR-02-021 (F5), 1.7km west of Drayton Bassett viaduct	360m east of the route	Mercia Mudstone Group	86mAOD	Surface water enters groundwater within Mercia Mudstone Group.
Issues 390m south-east of Woodside Farm Map WR-02-021 (F5), 1.8km west of Drayton Bassett viaduct	460m north-east of the route	Mercia Mudstone Group	84mAOD	May receive groundwater from Mercia Mudstone Group.
Pond 60m south of Mill House Map EC-04-059 (C7), 2.2km north of Drayton Bassett viaduct	136m west of the route	Mercia Mudstone Group	105mAOD	May receive groundwater from Mercia Mudstone Group.
Issues 170m west of Mill House Map WR-02-021 (F6), 2.1km south-west of Drayton Bassett viaduct	290m south-west of the route	Mercia Mudstone Group	103mAOD	May receive groundwater from Mercia Mudstone Group.
Issues 200m south-east of White House Farm Map WR-02-021 (F6), 2.4km south-west of Drayton Bassett viaduct	50m north-east of the route	Mercia Mudstone Group	95mAOD	May receive groundwater from Mercia Mudstone Group.
Issues 200m west of Fordway Farm Map WR-02-021 (F6), 2.2km south-west of Drayton Bassett viaduct	433m north-east of the route	Mercia Mudstone Group	85mAOD	May receive groundwater from Mercia Mudstone Group.
Unnamed watercourse Map WR-02-021 (F6), 2km south-east of Black Brook viaduct	Will be crossed by the route	Mercia Mudstone Group	Not applicable	May receive groundwater from Mercia Mudstone Group.
Sinks 230m south of Roundhill Wood Map WR-02-021 (G7), 2.7km south-west of Drayton Bassett viaduct	20m south-west	Envile Member	90mAOD	Sinks represent an extended culvert.

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Location description and map reference ¹³	Distance from route	Formation	Elevation	Comments
Unnamed watercourse 140m south-west of Roundhill Wood Map WR-02-021 (F6), 2km south-west of Drayton Bassett viaduct	Will be crossed by the route	Envile Member	Not applicable	May receive groundwater from Envile Member.
Issues 465m south-east of White Owl Farm Map WR-02-021 (F7), 2km east of Black Brook viaduct	370m south-west of the route	Envile Member	96mAOD	May receive groundwater from Envile Member.
Pond 140m south-east of Rookery Map EC-04-059 (H6), 1.1km south of Black Brook viaduct	95m west of the route	Envile Member	104mAOD	May receive groundwater from Envile Member, however located on elevated topography.
Pond 250m north-east of Brock Map EC-04-060 (G8), 1.3km east of Black Brook viaduct	580m west of the route	Envile Member	105mAOD	May receive groundwater from Envile Member, however located on elevated topography.
Pond 620m south-west of Rookery Farm Map EC-04-060 (G8), 1.6km east of Black Brook viaduct	1,300m west of the route	Envile Member	150mAOD	Located in a sand and gravel pit, may receive groundwater from Envile Member.
Black-Bourne Brook located north of Hints and flows south-east Map WR-02-021 (F6), Black Brook viaduct	Will be crossed by Black Brook viaduct	Alluvium superficial deposits underlain by Envile Member	Not applicable	May receive groundwater from Alluvium.
Issues 220m east of Rookery Map WR-02-021 (F6), 790m south east of Black Brook viaduct	150m east of the route	Envile Member	80mAOD	May receive groundwater from Envile Member.
Pond 170m east of Rough Leasow Map EC-04-060 (E8), 680m east of Black Brook viaduct	510m west of the route	Envile Member	117mAOD	Located on elevated topography therefore unlikely to be groundwater dependent.
Issues 170m south of Church Wood Map WR-02-021 (E7), 300m south of Black Brook viaduct	530m west of the route	Alluvium superficial deposits, underlain by Envile member	81mAOD	May receive groundwater from Alluvium.
Issues at Bourne House Map WR-02-021 (E7), 400m south of Black Brook viaduct	330m west of the route	Envile member	78mAOD	May receive groundwater from Envile Member.
Pond 390m south-east of Buck's Head Farm Map EC-04-060 (D5), 357m north-east of Black Brook viaduct	310m east of the route	Kidderminster Formation	95mAOD	Pond is likely to be a drainage ditch for the A5 road therefore unlikely to receive groundwater from the underlying geology.

Location description and map reference¹³	Distance from route	Formation	Elevation	Comments
Pond and unnamed watercourse near Bourne Cottage 190m south of Buck's Head Farm Map EC-04-060 (C7), 100m south of Black Brook viaduct	180m west of the route	Bromsgrove Sandstone Formation	90mAOD	May receive groundwater from Bromsgrove Sandstone Formation.
Pond 230m east of Buck's Head Farm Identifier: 030-AA-178003 Map EC-04-060 (C5), 375m north-east of Black Brook viaduct	215m east of the route	Kidderminster Formation	95mAOD	Pond is likely to be a drainage ditch for the A5 road therefore unlikely to receive groundwater from the underlying geology.
Pond 160m north-west of Buck's Head Farm Map EC-04-060 (B7), 620m west of Black Brook viaduct	160m west of the route	Bromsgrove Sandstone Formation	92mAOD	May receive groundwater from Bromsgrove Sandstone Formation, issues located nearby.
Pond 100m north-west of Buck's Head Farm Map EC-04-060 (B7), 538m north-west of Black Brook viaduct	138m west of the route	Bromsgrove Sandstone Formation	95mAOD	May receive groundwater from Bromsgrove Sandstone Formation, issues located nearby.
Drain Map WR-02-021 (E7), 690m north-west of Black Brook viaduct	88m west of the route	Bromsgrove Sandstone Formation	Not applicable	Man-made drain, unlikely to receive groundwater from the underlying geology.
Unnamed watercourse 370m south-west of Packington Moor Map WR-02-021 (C8), 1.9km west of Black Brook viaduct	145m west of the route	Bromsgrove Sandstone Formation	Not applicable	May receive groundwater from Bromsgrove Sandstone Formation.
Issues at Moor Covert Map WR-02-021 (D7), 2km west of Black Brook viaduct	140m west of the route	Bromsgrove Sandstone Formation	85mAOD	May receive groundwater from Bromsgrove Sandstone Formation.
Issues 40m north of Moor Covert Map WR-02-021 (D7), 2.2km west of Black Brook viaduct	283m west of the route	Bromsgrove Sandstone Formation	85mAOD	May receive groundwater from Bromsgrove Sandstone Formation.
Issues 235m north-west of Moor Covert Map WR-02-021 (D7), 2.1km west of Black Brook viaduct	535m west of the route	Bromsgrove Sandstone Formation	85mAOD	May receive groundwater from Bromsgrove Sandstone Formation.
Pond 300m west of Horsley Brook Farm Map EC-04-061 (D6), 3km north of Black Brook viaduct	95m east of the route	Bromsgrove Sandstone Formation	102mAOD	May receive groundwater from Bromsgrove Sandstone Formation, however located in farm fields therefore could potentially be an artificial feature and surface water dependent.
Issues 640m west of Ingleby Hill Map WR-02-021 (D6), 3km east of Black Brook viaduct	600m west of the route	Kidderminster Formation	91mAOD	May receive groundwater from Kidderminster Formation.

3.5 Water dependent habitats

3.5.1 Table 7 summarises the water dependent habitats within the study area. These have been identified from a review of Ordnance Survey (OS) mapping, aerial photography and from the following sources:

- information on designated and potential non-statutory Local Wildlife Sites (LWS) from Staffordshire Ecological Record¹⁴;
- information on statutory designated sites from Natural England; and
- information from ecological surveys carried out in support of the Environmental Impact Assessment (EIA).

3.5.2 The table identifies where water dependency may exist but the assessment of impact on water dependent ecology receptors is found in Volume 2, CFA Report 21, Section 7.

Table 7: Description of water dependent habitats

Location and map reference ¹⁵	Distance from route	Designation	Comments
Trickley Coppice Map EC-01-059 (G10), 1.8km west of Drayton Bassett viaduct	1,000m south-east of the route	Ancient and semi-natural woodland	Located on Secondary B aquifer (bedrock), and on Unproductive strata. Likely to be fed from Issues to north-east of location.
Shirral Coppice Map EC-01-059 (E9), 1.5km south-west of Drayton Bassett viaduct	700m west of the route	Ancient and semi-natural woodland	Located on Unproductive strata, Secondary B bedrock aquifer. Likely to be dependent on surface water.
Bangley Lane (Hedge 9) Map: EC-01-059 (D8), 1.6km north-west of Drayton Bassett viaduct	450m west of the route	Biodiversity alert site (BAS)	Located on Unproductive strata, site likely to be dependent on rainfall.
Waggoner's Lane (Hedge 1) Map EC-01-060 (J6), 2.3km west of Drayton Bassett viaduct	Will be crossed by route	Site of biological importance (SBI)	Unlikely to be groundwater dependent as the receptor is a hedgerow.
Brock Hurst Map EC-01-059 (A9), 2.1km east of Black Brook viaduct	400m west of the route	SBI and ancient woodland	Potentially groundwater dependent as located on Secondary A aquifer (bedrock).
Botley House to Bourne Bridge Map EC-01-059 (B1), 1.5km north-east of Black Brook viaduct	870m east of the route	BAS	Likely to be groundwater dependent, located on a Secondary A aquifer (superficial).
Ford (Oxbow Woodland) to Botley House, Bourne Brook Corridor Map EC-01-060 (G3), 1.2km east of Black Brook viaduct	200m east of the route	BAS	Likely to be groundwater dependent, located on a Secondary A aquifer (superficial).

¹⁴ Local wildlife sites in Staffordshire are called Sites of Biological Importance (SBI) and Biodiversity Alert Sites (BAS).

¹⁵ Map references taken from Volume 5: Map Book – Ecology, Maps EC-01-059 to EC-01-061a.

Location and map reference¹⁵	Distance from route	Designation	Comments
Roundhill Wood Map EC-01-060 (G5), 1.5km east of Black Brook viaduct	40m east of the route	SBI and ancient woodland	Unlikely to be groundwater dependent as receptor is situated on a hill.
Rookery Map EC-01-060 (F7), 1km east of Black Brook viaduct	Will be crossed by the route	SBI and ancient woodland	Unlikely to be groundwater dependent as receptor is situated on a hill.
Hints Wet Meadows (identified as wet habitat of concern) Map EC-01-060 (E6), 230m south-east of Black Brook viaduct	30m east of the route	Not designated Identified as wet habitat of concern	Potentially groundwater and surface water dependent as a drain flows through site and Black Brook is located along the eastern boundary.
Snakes Hill and River Oxbow, Black Brook Map EC-01-060 (E6), 700m north-east of Black Brook viaduct	100m east of the route	SBI	Likely to be groundwater dependent, located on a Secondary A aquifer (superficial).
Black Brook Corridor: Black Brook Bridge to Heart of England Way Map EC-01-060 (C7 to C10), 1.5km of north-east Black Brook viaduct	Will be crossed by the route	BAS	Likely to be groundwater dependent, located on a Secondary A aquifer (superficial).
Church Wood and Meadow between Church Wood and the Bourne Brook Map EC-01-060 (C8), 600m north-west of Black Brook viaduct	560m west of the route	BAS	Unlikely to be groundwater dependent as situated on high topography, located on Secondary A aquifer and Principal aquifer (both bedrock).
Rough Leasow Map EC-01-060 (D9), 600m south-west of Black Brook viaduct	600m west of the route	SBI and ancient woodland	Potentially groundwater dependent, located on a Secondary A aquifer (bedrock).
Moor Covet and Pool Map EC-01-061a (G7), 2km west of Black Brook viaduct	200m west of the route	SBI	Likely to be groundwater dependent, located on a Principal aquifer (bedrock) and supported by fissures.
Freeford Manor and Swinfen Park Map EC-01-061a (D9), 3km south-west of Black Brook viaduct	500m west of the route	SBI	Likely to be groundwater dependent, located on a Principal aquifer (bedrock).

4 Site-specific assessments

4.1 Surface water

4.1.1 Table 8 summarises the potential impacts and effects to surface water.

Table 8: Summary of potential impacts to surface water

Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Gallows Brook east of Upper House Farm. Map WR-01-035 (H5) (SWC-CFA21-001)	Moderate	Gallows Brook culvert Trickley Coppice embankment	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off. In-channel construction work has the potential to have a moderate impact on the existing water environment, flows and the ecology supported, through the disturbance of silt or direct contamination by polluting materials.	Adoption of Environment Agency Pollution Prevention Guidelines (PPGs) – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

¹⁶ Map references taken from Volume 5: Map Book – Water resources, Maps WR-01-035 and WR-01-036.¹⁷ For examples of receptor value see Table 43 in the SMR addendum Volume 5 Appendix CT-001-000/2.

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Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Gallows Brook culvert	Moderate adverse	Culvert may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Improvements along watercourse either side of culvert, to mitigate loss of open length.	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	None required	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	Construction (Permanent)
Tributary of River Tame – Source to Trickley Coppice Map WR-01-035 (G5) (SWC-CFA21-002)	Moderate	Drayton Bassett viaduct Drayton Lane Embankment	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and construction compounds.	Negligible Neutral (not significant)	None required	Negligible (not significant)	Construction (Temporary)

Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Tributary of River Tame – Crossing south of Shirral Drive. Map WR-01-035 (G5) (SWC-CFA21-003)	Moderate	Drayton Bassett viaduct Permanent diversion of Shirral Drive and Drayton Lane A453 overbridge Drainage outfall Balancing pond	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

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Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall (from the railway).	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages.</p> <p>Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.</p>	<p>Negligible Neutral (not significant)</p>	<p>None required</p>	<p>Negligible Neutral (not significant)</p>	Construction (Permanent)
		Drainage outfall (from diversion of Shirall Drive and Drayton Lane. Assumed to have mitigation and outfall to tributary of River Tame Langley Brook).	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from both routine discharges from the road and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the road and to provide temporary storage for potential spillages.</p>	<p>Negligible Neutral (not significant)</p>	<p>None required</p>	<p>Negligible Neutral (not significant)</p>	Construction (Permanent)

Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall (associated with A453 overbridge. Assumed to have mitigation and outfall to tributary of River Tame).	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface water from both routine discharges from the road and associated infrastructure or from accidental spillages.</p> <p>Initial water quality tests (HAWRAT from the DMRB¹⁸) have shown that mitigation is required to offset potential impacts to the water environment (particularly to address copper concentrations and the dispersal of sediments).</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the road and to provide temporary storage for potential spillages.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Operation

¹⁸ DMRB (2009), Volume 11 Section 3 Part 10 HD45/09 Road Drainage and the Water Environment.

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Surface water feature/receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Pond south of Shirral Drive Map WR-01-035 (G5) (SWC-CFA21-004)				Refer to CFA Report 21, Section 7 Ecology for impacts assessment.					
Pond at Barn Cottage Map WR-01-035 (F5) (SWC-CFA21-005)				Refer to CFA Report 21, Section 7 Ecology for impacts assessment.					
Tributary of Bourne Brook at Bangley Lane (watercourse does not intersect proposed route) Map WR-01-035 (E4)	Moderate	Permanent diversion of Bangley Lane Embankment including surface drainage Drainage outfall Balancing pond	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall (from railway)	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface waters from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages.</p> <p>Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.</p>	<p>Negligible Neutral (not significant)</p>	<p>None required</p>	<p>Negligible Neutral (not significant)</p>	Construction (Permanent)
		Drainage outfall (from Bangley Lane. Assumed to have mitigation and outfall to tributary of Bourne Brook).	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface waters from both routine discharges from the road and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the road and to provide temporary storage for potential spillages.</p>	<p>Negligible Neutral (not significant)</p>	<p>None required</p>	<p>Negligible Neutral (not significant)</p>	Construction (Permanent)

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Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Operation
Tributary of Bourne Brook at White House Farm Map WR-01-035 (D6) (SWC-CFA21-006)	Moderate	Hints culvert Hints embankment	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off. In channel construction work has the potential to have a moderate impact on the existing water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination of polluting materials.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Hints culvert	Moderate adverse	Culvert may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Improvements along watercourse either side of culvert, to mitigate loss of open length.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Tributary of Bourne Brook at Roundhill Wood Map WR-01-035 (D6) (SWC-CFA21-007)	Moderate	Roundhill Wood culvert Milditch Wood embankment Realignment of watercourse to allow single crossing and embankment profile	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off In channel construction work has the potential to have a moderate impact on the existing water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination of polluting materials.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

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Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Roundhill Wood culvert	Moderate adverse	Culvert may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Improvements along watercourse either side of culvert, to mitigate loss of open length.	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	None required	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	Construction (Permanent)
		Realignment of watercourse to allow single crossing and new embankment profile.	Moderate adverse	Deterioration or loss of the existing water environment, flows and the ecology supported.	Opportunities will be taken to retain and if possible enhance the overall quality of the watercourses, for example by including meanders and enhanced banks.	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	None required	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	Construction (Permanent)

Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Second crossing of tributary of Bourne Brook at Roundhill Wood. Map WR-01-035 (D6) (SWC-CFA21-008)	Moderate	Roundhill Wood culvert Milditch Wood embankment Realignment of watercourse to swallow single crossing and new embankment profile.	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off. In channel construction work has the potential to have a moderate impact on the existing water environment, flows and the ecology supported, through the disturbance of silt or the direct contamination of polluting materials.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

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Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Roundhill Wood culvert	Moderate adverse	Culvert may impact on the existing water environment, potentially changing flow characteristics and the ecology supported.	Improvements along watercourse either side of culvert, to mitigate loss of open length.	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	None required	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	Construction (Permanent)
		Realignment of watercourse to allow single crossing and new embankment profile.	Moderate adverse	Deterioration or loss of the existing water environment, flows and the ecology supported.	Opportunities will be taken to retain and if possible enhance the overall quality of the watercourses, for example by including meanders and enhanced banks.	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	None required	Minor to Minor Beneficial Slight to Slight Beneficial (not significant)	Construction (Permanent)

Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Black Brook at Bourne House Map WR-01-035 (B5) (SWC-CFA21-009)	High	Black Brook viaduct Buck's Head embankment and associated land drainage works A5 overbridge Drainage outfalls Balancing ponds	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at main and satellite construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

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Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfalls (from railway)	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface waters from both routine discharges from the proposed railway and associated infrastructure or from accidental spillages.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the proposed railway and to provide temporary storage for potential spillages.</p> <p>Balancing pond before outfall to watercourse to restrict run-off rates and reduce the effect on water quality by reducing potential contaminants through filtration, vegetative absorption or settlement.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>		<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Permanent)

Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall (associated with A5 overbridge)	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface waters from both routine discharges from the road and associated infrastructure or from accidental spillages.</p> <p>Initial Highway Agency Water Risk Assessment Tool (HAWRAT) result show that mitigation would be required to offset the potential impacts the water environment.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the road and to provide temporary storage for potential spillages.</p>	<p>Negligible Neutral (not significant)</p>	<p>None required</p>	<p>Negligible Neutral (not significant)</p>	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	<p>Negligible Neutral (not significant)</p>	<p>None required</p>	<p>Negligible Neutral (not significant)</p>	Operation

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Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Local drainage around Flats Lane. Note ultimately drains to Fisherwick Brook at Mill Farm which is not within this CFA. Map WR-01-036 (E5)	Moderate	Permanent diversion of Flats Lane	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids;	Adoption of Environment Agency PPGs – particularly PPG5 for in-channel works.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)
		Drainage outfall Flats Lane culvert		The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at construction compounds.				
		Drainage outfall (from permanent diversion of Flats Lane. Drainage from road assumed to join Fisherwick Brook)	Moderate adverse	Impact on flows in the receiving watercourse. Deterioration of water quality due to contamination of surface waters from both routine discharges from the road and associated infrastructure or from accidental spillages.	Drainage has been designed to reduce the rate and volume of run-off from the road and to provide temporary storage for potential spillages.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)

Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Operation
Local drainage around A51 (Tamworth Road). Note ultimately drains to Fisherwick Brook at Mill Farm which is not within this CFA. Map WR-01-036 (C5)	Moderate	A51 overbridge Drainage outfall	Moderate adverse	Deterioration of water quality due to: Deposition of soils, sediment and other construction materials, and spillage of fuels and other hazardous liquids; The mobilisation of contaminants following disturbance of contaminated ground or groundwater; Uncontrolled site run-off.	Adoption of Environment Agency PPGs particularly PPG5 for in-channel works. Mitigation measures outlined in draft CoCP. Water management implemented during earthworks operation. Temporary site drainage designed to retain surface run-off within site boundary. Grey water systems used at construction compounds.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Temporary)

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Surface water feature/ receptor ¹⁶	Value of surface water feature ¹⁷	Design element	Magnitude of impact (no mitigation)	Potential impact to water resource	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
		Drainage outfall (from A51 overbridge. Drainage from road assumed to join Fisherwick Brook)	Moderate adverse	<p>Impact on flows in the receiving watercourse.</p> <p>Deterioration of water quality due to contamination of surface waters from both routine discharges from the road and associated infrastructure or from accidental spillages.</p> <p>Initial water quality tests (HAWRAT from the DMRB¹⁹) have shown that mitigation is required to offset potential impacts to the water environment.</p>	<p>Drainage has been designed to reduce the rate and volume of run-off from the road and to provide temporary storage for potential spillages.</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Construction (Permanent)
		All elements (maintenance)	Moderate adverse	Deterioration of water quality due to contamination from de-icing substances used during cold weather and herbicides for managing vegetation on the tracks.	Best practice pollution control guidance will be adopted for maintenance of the Proposed Scheme.	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	<p>None required</p>	<p>Negligible</p> <p>Neutral</p> <p>(not significant)</p>	Operation

¹⁹ DMRB (2009), Volume 11 Section 3 Part 10 HD45/09 Road Drainage and the Water Environment.

4.2 Groundwater

4.2.1 Following the methodology outlined in the SMR addendum (see Volume 5: Appendix CT-001-000/2), the hydraulic conductivity values; obtained from available literature values, were used in conjunction with professional judgment to estimate the maximum extent of the zone of influence that is likely to be produced when dewatering of a cutting occurs. The hydraulic conductivity values used are generally in the high range of literature values to provide a realistic factor of safety to the estimated zone of influence. Based on this worst case assumption, the zone of influence is likely to be overestimated; however, for the purpose of this preliminary assessment, this approach is considered to be acceptable.

4.2.2 Aquifer properties used for estimating the zone of influence can be found in Table 9.

Table 9: Aquifer Properties

Lithology	Maximum hydraulic conductivity value used in calculations	References
Mercia Mudstone Group-Mudstone	0.1m/d	Hiscock 2005 ²⁰
Bromsgrove Sandstone Formation	2.71m/d	BGS Major Aquifers Properties Manual ²¹
Kidderminster Formation	33.3m/d	BGS Major Aquifers Properties Manual
Envile Member	7m/d	WSP 2011 ²²
Alluvium	864m/d	Hiscock 2005
Glaciolacustrine Deposits – clay and silt	0.0000864m/d	Hiscock 2005

4.2.3 The zone of influence for the dewatering of the cuttings along the route was calculated at frequent intervals as topography, geology and track level will change, using the methodology outlined in the SMR addendum (see Volume 5: Appendix CT-001-000/2) and the properties in Table 9.

4.2.4 Table 10 summarises the estimated zone of influence within the study area for each of the cuttings. In each case, the maximum zone of influence value reported has not been applied to the whole extent of the cutting; it is purely illustrative of the worst-case conditions at its deepest section.

4.2.5 Table 11 summarises the potential impacts to groundwater, abstractions, water dependent habitats and groundwater/surface water interactions.

²⁰ Hiscock, K.M. (2005), Hydrogeology: Principles and Practice, Blackwell Science Ltd, Oxford.

²¹ British Geological Survey (1997), *The Physical Properties of Major Aquifers in England and Wales*. P199.

²² WSP (2011), *Land quality assessment: Former Little Heath Site*, Coventry.

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Table 10: Extent of zone of influence within CFA21

Cutting	Geology	Maximum drawdown	Minimum zone of influence	Maximum zone of influence	Comments
Drayton Lane Cutting	Mercia Mudstone Group – Mudstone (Bedrock)	16m	5.16m	51.64m	
	Till diamicton	4m	0.01m	16.97m	
Hints Cutting	Envile Member	15m	83.85m	405.05m	
Swinfen Cutting	Kidderminster Formation	13m	141.66m	765.65m	
	Kidderminster Formation overlying Bromsgrove Sandstone Formation	11m	107.58m	528.69m	Predominantly Kidderminster Formation overlying Bromsgrove Sandstone Formation. Bulk hydraulic conductivity was used when cutting intersects Kidderminster Formation overlying Bromsgrove Sandstone Formation.
	Kidderminster Formation overlying Bromsgrove Sandstone Formation	12m	89m	201.62m	Predominantly Bromsgrove Sandstone Formation overlain by Kidderminster Formation. Bulk hydraulic conductivity was used when cutting intersects Kidderminster Formation overlying Bromsgrove Sandstone Formation.
	Bromsgrove Sandstone Formation	15m	111.45m	252.02m	

Table 11: Summary of potential impacts to groundwater, abstractions, water dependent habitats and groundwater/surface water interactions

Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Aquifers								
Bedrock, Bromsgrove Sandstone Formation and Kidderminster Formation, Principal aquifers (high).	Various including: Swinfen cutting Drayton lane auto-transformer station	Moderate adverse	Dewatering may reduce the groundwater levels within the aquifer. Potential for contaminants to enter the groundwater during construction (e.g. suspended solids, leaks from machinery).	Sustainable drainage systems (SuDS) in the form of infiltration trenches will be located where gravity transfer is feasible to facilitate groundwater recharge. Contamination control measures as required by the draft CoCP Section 16.	Negligible Neutral (not significant)	None required	Neutral Neutral (not significant)	Construction (Permanent)
Hopwas Breccia Formation, Principal aquifer (high).	Milditch Wood embankment	Negligible	Reduced infiltration could potentially reduce groundwater levels.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Bedrock, Salop Formation (Envile Member), Secondary A aquifer (moderate).	Various including: Hints cutting Milditch Wood embankment	Moderate adverse	Dewatering could reduce groundwater levels. Potential for contaminants to enter the groundwater during construction (e.g. suspended solids, leaks from machinery).	SuDS in the form of infiltration trenches will be located where gravity transfer is feasible to facilitate groundwater recharge. Contamination control measures as required by the draft CoCP Section 16.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)

²³ Map references taken from Volume 5: Map Book – Water resources, Map WR-02-021 and Volume 5: Map Book – Ecology, Maps EC-01 to EC-04.²⁴ For examples of receptor value see Table 43 in the SMR addendum Volume 5 Appendix CT-001-000/2.

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Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Bedrock, Mercia Mudstone Group- Mudstone, Secondary B aquifer (moderate).	Various including: Drayton Lane embankment Drayton Lane cutting Drayton Bassett viaduct	Moderate adverse	Dewatering could reduce groundwater levels. Potential for contaminants to enter the groundwater during construction (e.g. suspended solids, leaks from machinery).	SuDS in the form of infiltration trenches will be located where gravity transfer is feasible to facilitate groundwater recharge. Contamination control measures as required by the draft CoCP Section 16.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Superficial Deposits, Alluvium, Secondary A aquifer (moderate).	Various including: Drayton Bassett viaduct Black Brook viaduct	Moderate adverse	Dewatering could reduce groundwater levels. Potential for contaminants to enter the groundwater during construction (e.g. suspended solids, leaks from machinery).	SuDS in the form of infiltration trenches will be located where gravity transfer is feasible to facilitate groundwater recharge. Contamination control measures as required by the draft CoCP Section 16.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Superficial Deposits, River Terrace Gravels, Secondary A aquifer (moderate).	Trickley Coppice embankment	Minor adverse	Reduced infiltration could reduce groundwater levels. Potential for contaminants to enter the groundwater during construction (e.g. suspended solids, leaks from machinery).	SuDS such as infiltration trenches will be located where gravity transfer is feasible to facilitate groundwater recharge. Contamination control measures as required by the draft CoCP Section 16.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)

Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Superficial Deposits, Mid Pleistocene Till, Unproductive (low).	Various including: Drayton Lane cutting Overbridges	Negligible	Unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Abstractions								
03/28/17/0076/1 Canwell park-borehole (high) Map WR-02-021 (F8), 4.9km south-west of Black Brook viaduct.	Hints cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
03/28/17/0043 Hints, Tamworth – Seepage Reservoir (high). Map WR-02-021 (F6), 1.9km north-east of Black Brook viaduct.	Hints cutting	Negligible	Not located in the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
03/28/17/0048 Hints Quarry, Near Tamworth – Borehole (high). Map WR-02-021 (E6), 1km north of Black Brook viaduct.	Swinfen cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

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Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
03/28/17/0041 Hints Quarry, Staffs – Borehole (high). Map WR-02-021 (E6), 1km north of Black Brook viaduct.	Swinfen cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
03/28/22/0036 Hopwas Quarry Borehole (high) Map WR-02-021 (E5), 1.8km north-east of Black Brook viaduct.	Swinfen cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
03/28/22/0062 Flats Lane, Weeford – Borehole (high). Map WR-02-021 (E7), 900m west of Black Brook viaduct.	Swinfen cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
03/28/22/0038 Packington Moor Farm – Borehole (high). Map WR-02-021 (D7), 2km west of Black Brook viaduct.	Swinfen cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Water dependent habitats								
Trickley Coppice (high). Map EC-01 – 059 (G10), 1.8km west of Drayton Bassett viaduct.	Drayton Bassett viaduct	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Shirral Coppice (high). Map EC-01-059 (E9), 1.5km south-west of Drayton Bassett viaduct.	Drayton Lane cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Bangley Lane (Hedge 9) (moderate) Map EC-01-059 (D8), 1.6km north-west of Drayton Bassett viaduct.	Drayton lane cutting	Negligible	Receptor not groundwater dependent therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Waggoner's Lane (moderate). Map EC-01-060 (J6), 2.3km west of Drayton Bassett viaduct.	Drayton Lane cutting	Negligible	Negligible impact from groundwater, however major impact due to being cut by route.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Brock Hurst (high). Map EC-01-059 (B1), 2.1km east of Black Brook viaduct.	Drayton Lane cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

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Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Botley House to Bourne Bridge, Bourne Brook (moderate). Map EC-01-059 (B1), 1.5km north-east of Black Brook viaduct.	Hints cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Ford (Oxbow Woodland) to Botley House, Bourne Brook Corridor (moderate). Map EC-01-060 (G3), 1.2km east of Black Brook viaduct.	Hints cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Roundhill Wood (high). Map EC-01-060 (G5), 1.5km east of Black Brook viaduct.	Hints cutting	Negligible	Located within zone of influence on productive strata, however situated on a hill therefore unlikely to be groundwater dependent.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Rookery (high). Map EC-01-060 (F7), 1km east of Black Brook viaduct.	Hints cutting	Negligible	Located within zone of influence on productive strata, however situated on a hill therefore unlikely to be groundwater dependent.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Hints Wet Meadows (moderate). Map EC-01-060 (E6), 230m south-east of Black Brook viaduct.	Milditch Wood embankment	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Snakes Hill and River Oxbow, Black Brook (moderate). Map EC-01-060 (E6), 700m north-east of Black Brook viaduct.	Swinfen cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Black Brook Corridor: Black Brook Bridge to heart of England Way (moderate). Map EC-01-060 (C7 to C10), 1.5km north-east of Black Brook viaduct.	Swinfen cutting Black Brook viaduct	Moderate adverse	Located within zone of influence therefore dewatering could reduce groundwater levels which may have an adverse impact to the receptor.	SuDS in the form of infiltration trenches will be located to the south of Swinfen cutting near Black Brook viaduct to facilitate groundwater recharge. Contamination control measures as required by the draft CoCP Section 16. Monitoring may be required to assess groundwater dependency.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Church Wood and meadow between Church Wood and the Bourne Brook (moderate). Map EC-01-060 (C8), 600m north-west of Black Brook viaduct.	Swinfen cutting	Negligible	Located on high topography therefore unlikely to be groundwater dependent.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

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Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Rough Leasow (high). Map EC-01-060 (D9), 600m south-west of Black Brook viaduct.	Swinfen cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Moor Covet and Pool (moderate). Map EC-01-061a (G7), 2km west of Black Brook viaduct.	Swinfen cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Freeford Manor and Swinfen Park (moderate). Map EC-01-061a (D9), 3km south-west of Black Brook viaduct.	Swinfen cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Surface water and groundwater interaction								
Pond 60m west of the route (low). Map EC-04-059 (J6), 380m south of Drayton Bassett viaduct.	Trickley Coppice embankment	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				
Pond 50m west of the route (low). Map EC-04-059 (J6), 380m south of Drayton Bassett viaduct.	Trickley Coppice embankment	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				

Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Pond 30m west of the route (low). Map EC-04-059 (I6), 380m south of Drayton Bassett viaduct.	Trickley Coppice embankment	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				
Pond 55m west of the route (low). Map EC-04-059 (I6), 380m south of Drayton Bassett viaduct.	Trickley Coppice embankment	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				
Pond 25m east of the route (low). Map EC-04-059 (I6), 360m south of Drayton Bassett viaduct).	Trickley Coppice embankment	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				
Issues, 200m south-west of the route (moderate). Map WR-02-021 (H5), 650m east of Drayton Bassett viaduct.	Trickley Coppice embankment	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues 1.3km south-west of the route (moderate). Map WR-02-021 (G6) 1.2km south of Drayton Bassett viaduct.	Drayton Lane cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

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Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Issues 1.3km south-west of the route (moderate). Map WR-02-021 (G6) 1.2km south of Drayton Bassett viaduct.	Drayton Lane cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Pond, will be crossed by route (low). Map EC-04-059 (G6) 300m west of Drayton Bassett viaduct.	Drayton Lane cutting	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				
Unnamed watercourse, will be crossed by the route (moderate). Map WR-02-021 (I5), 512m south-west of Drayton Bassett viaduct.	Drayton Lane cutting	Negligible	Not located within the zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues, 580m north-east of the route (moderate). Map WR-02-021 (F5) 2km north-east Black Brook viaduct.	Drayton Lane cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Pond, will be crossed by route (low). Map EC-04-059 (F6) 300m west Drayton Bassett viaduct.	Drayton Lane cutting	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				

Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Pond, 80m east of the route (low). Map EC-04-059 (E6) 1.6km north-west of Drayton Bassett viaduct.	Drayton Lane cutting	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				
Issues, 50m north-east of the route (moderate). Map WR-02-021 (F5), 2km west of Drayton Bassett viaduct.	Drayton Lane cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Sinks, 360m east of the route (moderate). Map WR-02-021 (F5), 1.7km west of Drayton Bassett viaduct.	Drayton Lane cutting	Negligible	Not located within zone of influence and not groundwater dependent therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues, 460m north-east of the route (moderate). Map WR-02-021 (F5) 1.8km west of Drayton Bassett viaduct.	Drayton Lane cutting	Negligible	Not located in zone of influence therefore unlikely to receive negative impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Pond, 136m west of the route (low). Map EC-04-059 (C7) 2.2km north of Drayton Bassett viaduct.	Drayton Bassett cutting	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				

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Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Issues, 290m south-west of the route (moderate). Map WR-02-021 (F6), 2.1km south-west of Drayton Bassett viaduct.	Drayton Lane cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues, 50m north-east of the route (moderate). Map WR-02-021 (F6), 2.4km south-west of Drayton Bassett viaduct.	Hints embankment	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues, 433m north-east of the route (moderate). Map WR-02-021 (F6), 2.2km south-west of Drayton Bassett viaduct.	Hints embankment	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Unnamed watercourse, will be crossed by the route (moderate). Map WR-02-021 (F6), 2km south-east of Black Brook viaduct.	Hints embankment	Moderate adverse	Embankments could reduce recharge to the river and groundwater.	SuDS in the form of infiltration trenches will be located along the edge of the embankment to facilitate groundwater recharge. Watercourse to be culverted.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Sinks, 20m east of the route (moderate). Map WR-02-021 (G7), 2.7km south-west of Drayton Bassett viaduct.	Hints embankment	Negligible	Sinks represent an extended culvert therefore are not likely to be impacted by changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Unnamed watercourse, will be crossed by the route (moderate). Map WR-02-021 (F6), 2km south-west Drayton Bassett viaduct.	Hints cutting	Moderate adverse	The watercourse is within the zone of influence and therefore the total volume of water sourcing the watercourse could locally decrease through leakage to the underlying aquifers.	SuDS in the form of infiltration trenches will be located in the southern end of Hints cutting to facilitate groundwater recharge. Contamination control measures as required by the draft CoCP Section 16.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Issues, 370m south-west of the route (moderate). Map WR-02-021 (F7), 2.0km east of Black Brook viaduct.	Hints cutting	Moderate adverse	Located within zone of influence and on a Principal aquifer therefore could potentially receive adverse impacts from reduced groundwater yields.	SuDS in the form of infiltration trenches will be located in the south of Hints cutting to facilitate groundwater recharge. Contamination control measures as required by the draft CoCP Section 16.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Pond, 95m west of the route (low). Map EC-04-059 (H6) 1.1km south of Black Brook viaduct.	Hints cutting	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				
Pond, 580m west of the route (low). Map EC-04-060 (G8) 1.3km east of Black Brook viaduct.	Hints cutting	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				

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Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Pond, 1.3km west of the route (low). Map EC-04-060 (G8) 1.6km east of Black Brook Viaduct.	Hints cutting	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				
Black Brook/Bourne Brook, will be crossed by route (high). Map WR-02-021 (F6), will be crossed by Black Brook viaduct.	Hints cutting	Negligible	Bourne Brook not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
	Black Brook viaduct, Swinfen cutting	Negligible	Partly within the zone of influence, however unlikely to receive any adverse impacts to the overall flow and water balance of the Brook.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues, 150m east of the route (moderate). Map WR-02-021 (F6), 790m south-east of Black Brook viaduct.	Swinfen cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Pond, 510m west of the route (low). Map EC-04-060 (E8) 680m east of Black Brook viaduct.	Swinfen cutting	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				

Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Issues, 530m west of the route (moderate). Map WR-02-021 (E7), 300m south of Black Brook viaduct.	Swinfen cutting	Minor adverse	Issues likely to be from the alluvium which is not cut by route, however it is located within the zone of influence produced within the bedrock aquifer.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues, 330m west of the route (moderate). Map WR-02-021 (E7), 400m south of Black Brook viaduct.	Swinfen cutting	Moderate adverse	Located within the zone of influence therefore dewatering could reduce groundwater levels which could have an adverse impact on the issues.	SuDS in the form of infiltration trenches to facilitate groundwater recharge. Contamination control measures as required by the draft CoCP Section 16.	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Pond, 310m east of the route (low). Map EC-04-060 (D5), 357m north-east of Black Brook viaduct.	Swinfen cutting	Negligible	Unlikely to be groundwater dependent. Pond appears to be man-made and located on the edge of A5 road.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Pond and unnamed watercourse, 180m west of the route (low). Map EC-04-060 (C7), 100m south of Black Brook viaduct.	Swinfen cutting	Moderate adverse	Located within zone of influence on elevated topography and is fed by an issue therefore may receive an adverse impact if the issue sourcing the pond and watercourse is impacted.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)

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Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Pond, 215m east of the route (low). Identifier:030-AA-178003 Map EC-04-060 (C5), 375m north-east of Black Brook viaduct.	Swinfen cutting	Negligible	Unlikely to be groundwater dependent. Pond appears to be man-made and located on the edge of A5 road.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	Construction (Permanent)
Pond, 160m west of the route (low). Map EC-04-060 (B7), 620m west of Black Brook viaduct.	Swinfen cutting	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				
Pond, 138m west of the route (low). Map EC-04-060 (B7), 538m north-west of Black Brook viaduct.	Swinfen cutting	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				
Drain, 88m west of the route (low). Map WR-02-021 (E7), 690m north-west of Black Brook viaduct.	Swinfen cutting	Negligible	Unlikely to be groundwater dependent therefore unlikely to be impacted to changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Unnamed watercourse, 145m west of the route (moderate). Map WR-02-021 (F6), 2km south-west of Drayton Bassett viaduct.	Swinfen Cutting	Negligible	Not located within zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues, 140m west of the route (moderate). Map WR-02-021 (D7), 2km west of Black Brook viaduct.	Swinfen cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues, 283m west of the route (moderate). Map WR-02-021 (D7), 2.2km west of Black Brook viaduct.	Swinfen cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Issues, 535m west of the route (moderate). Map WR-02-021 (D7), 2.1km west of Black Brook viaduct.	Swinfen Cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None
Pond, 95m east of the route (low). Map EC-04-061 (D6), 3km north of Black Brook viaduct.	Swinfen cutting	Major adverse	Pond assumed to be lost in order to accommodate the Proposed Scheme.	Refer to Ecology Volume2, CFA Report 21, Section 7.				

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Groundwater receptor ²³ (and value ²⁴)	Design element	Magnitude of impact (no mitigation)	Potential impact to groundwater	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Issues, 600m west of the route (moderate). Map WR-02-021 (D6), 3km east of Black Brook viaduct.	Swinfen cutting	Negligible	Not located in zone of influence therefore unlikely to receive adverse impacts from changes to groundwater.	None required	Negligible Neutral (not significant)	None required	Negligible Neutral (not significant)	None

5 References

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